



NSABB Meeting

FAS Biosecurity Project

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Federation of American Scientists

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www.FAS.org/biosecurity



Biosecurity Education for Biologists

NEED?

- In 2003, the National Research Council proposed the development of materials to educate scientists about their responsibilities in dual use research.

Dual-Use Education Case Studies

- **Computer-based modules** to extend lessons beyond the classroom.
- **Multimedia presentations** that will teach graduate students and advanced undergraduates awareness of dual use research.
- **Use real case scenarios** to illustrate the ethical dilemmas and the potential misuse of research.
- **Spark discussion** of the responsibility of scientists to limit risks.

First 8 Modules

- 1. Introduction
- 2. Polio from scratch: Eckard Wimmer
- 3. Inhalation drugs: David Edwards
- 4. Mousepox virulence: Ron Jackson
- 5. Antibiotic Resistance: Stuart Levy
- 6: RNAi: Greg Hannon
- 7: 1918 Influenza: Chris Basler
- 8. Public Concerns: ???????

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Let's take it for a spin...
www.fas.org/biosecurity/education

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Case Studies in Dual Use BIOLOGICAL RESEARCH



Technical advances in modern molecular biology have increased the risk that research could be used against us by those with malicious intent. It is important that biologists increase their awareness of biosecurity issues and learn to assess their research in terms of modern security concerns to minimize that possibility.

The case studies presented here will help define the issues associated with "dual-use" research and security in the research lab. They include interviews with researchers whose legitimate scientific work could potentially be used for questionable or harmful endeavors, as well as a historical perspective on their research, bioterrorism, and research regulations. We have included primary scientific research papers and discussion questions that are meant to raise awareness about the importance of responsible biological research.

- Module 1.0 Introduction
- Module 2.0 Synthesizing Polio Virus
- Module 3.0 Aerosol Drug Delivery Research
- Module 4.0 Unexpected Results in Virus Research
- Module 5.0 Experiments in Antibiotic Resistance
- Module Biosecurity Resources

Video



Click the play video button to view a clip on "Dr Jackson describing the mousepox experiments."

STOP VIDEO



Topic:

[History of Transgenics](#)

["Mousepox" Experiment](#)

[Implications and Public Reaction](#)

[Discussion](#)

[References](#)

[Home](#)

Genetic engineering has also provided an alternative to chemical pesticides through the use of transgenic crops. These techniques have varied from inserting genes to produce a natural or synthesized toxin to increase plant resistance to insertion of genes that enhance plant immunity to pathogens. Research into genetically modifying insects to lower the cost of sterile release programs has great potential as well.

Non-traditional means of controlling animal pest populations, such as mice, rats, and rabbits, have a long history, particularly in Australia where non-native species have overrun the continent. In the face of an out-of-control wild rabbit population, the Australian government in 1950 released a rabbit-specific pox virus, myxoma, into the wild. The virus quickly decimated the rabbit population, but over time proved to be ineffective as resistance increased.

As early as 1997, the Australian government realized both the promise of and potential controversy associated with using infectious transgenic viruses as "carriers" of immunocontraceptive genes that would effectively immunize the host animal against their own reproductive proteins.

Video

Click the play video button to view a clip of Dr. Levy discussing dual-use research.



There is a concern that publishing experiments like those done in the Levy paper may pose a biosecurity threat because it provides instructions for a rogue individual or group to create pathogens like *Y. pestis* that are resistant to standard treatment. Making antibiotic-resistant bacterial strains by inserting a plasmid expressing resistance to a specific known antibiotic is routine in most biology research labs. However, Levy was able to show that resistance to six common antibiotics could be transferred from one type of bacteria to another via a single gene. Two of the antibiotics, tetracycline and chloramphenicol, are currently used to treat plague infections.

States or organizations interested in developing biological weapons could cultivate antibiotic resistant pathogens to ensure that if released they would do as much damage as possible. Ken Alibek, a former Soviet biological weapons leader, has reported that during the 1980's the Soviet Union developed antibiotic-resistant strains of plague, anthrax, tularemia, and glanders bacteria. More recently, the Iraqi regime of Saddam Hussein also employed an ambitious bioweapons program focusing on anthrax, botulinum toxin and aflatoxin. The directors of the program, two women known as "Dr. Germ" and "Mrs. Anthrax" were arrested in 2003, shortly after the overthrow of Saddam.



Antibiotic Resistance Case Study

Module 5.0

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Topic: Experiments in Antibiotic Resistance

Multiple Drug Resistance

To test antibiotic resistance, plates were streaked with bacteria and disks saturated with different antibiotics were placed on them. Susceptible bacteria are unable to grow near the disks, forming a clear halo around them, but *E. coli* and *Y. pestis* expressing MarA47YP were not affected by the antibiotics and were able to grow right up to the disks. Bacteria expressing YPO1737 did not become resistant to the antibiotics, meaning that despite the difference in size, *marA47YP* was the most likely *marA* gene in *Y. pestis*. By overexpressing a single gene, *Y. pestis* was created that showed resistance to tetracycline, rifampicin, chloramphenicol, doxycycline, nalidixic acid and norfloxacin.

MarA47YP was able to cause antibiotic resistance like MarA, but to confirm that its mechanism of action was the same, an analysis of transcription by real-time PCR (RT-PCR) was done. When MarA47YP was overexpressed in *Y. pestis*, the transcription of the efflux pump also increased, showing that this is a conserved mechanism of resistance. A further experiment was done

where *Y. pestis* was grown in the presence of low levels of tetracycline to induce spontaneous mutations that caused the bacteria to be resistant.



Case Studies in Dual Use BIOLOGICAL RESEARCH



Win an 8GB iPod nano!
Complete an online survey on the case studies and be entered to win. Click here to go to the survey.
Now through May 31, 2007

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Module 1.0

Introduction



Module 2.0

Synthesizing Polio Virus



Module 3.0

Aerosol Drug Delivery
Research

Module 4.0

Unexpected Results
in Virus Research

Module 5.0

Experiments in
Antibiotic Resistance

Module

Biosecurity Resources



What do students think?

- 92% of respondents thought dual-use education should be taught in graduate student ethics courses.
- Approximately 1/3 were from outside the US.
- 1/2 wanted more material and 1/2 wanted less.
- 70% wanted more videos.
- Mixed reaction on the responsibility of scientists.

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Biosecurity and Biodefense Resource

The Federation of American Scientists has created an internet resource for biosecurity policy, bioterrorism information, and biodefense research. The organizations listed here represent various perspectives on what actions individual scientists, research institutions, science journals, the public, and government can do to minimize the threat of bioterrorism while maximizing the benefits of life science research.

[Biosecurity
Educational Modules](#)[Biological Threat
Agents Information](#)[International
Organizations](#)[Introduction to
Biological Weapons](#)[Legislation, Executive
Orders, and Treaties](#)[Non-Governmental
Organizations](#)[Reports](#)[U.S. Government
Agencies](#)[University
Policy Centers](#)

U.S. Biodefense Research Map

This interactive map provides the locations of both operational and planned **Biosafety Level-4 (BSL-4)** laboratories in the United States as well as the **National Biocontainment Laboratories (NBLs)**, the **Regional Biocontainment Laboratories (RBLs)**, and the **Regional Centers of Excellence (RCE) for Biodefense and Emerging Infectious Diseases**, both established by the

Distribution point

- Several other groups are producing education materials.
- We will be distributing any material we can find through our website and DVDs.
- Still seen as an FAS initiative, not a community resource.



Let's assume everyone
is aware (whatever that
means)...Now what?



What are a scientist's options?

- There is no place to turn if a scientist has concerns about a colleague.
- No place to get advice or vet concerns about their own work.
- There is no tracking of concerns.
- There is no method to report serious concerns to law enforcement.
- We are raising awareness without guidance on what to do.



Addressing outreach challenges...

What have we learned?



Planning outreach without knowing what you are up against is foolish.

Law enforcement case study

How do scientists view law enforcement?

Problem: Anecdotal evidence that scientists do not trust law enforcement, which is hampering outreach activities.

Solution:

- Survey the scientific community
- Release data publicly
- Create training materials for field agents

Survey Details

FULL RESULTS COMING SOON

- 1332 Respondents (AAAS members)
- January 24-February 18, 2008
- Multiple disciplines
- Most respondents were from the life sciences.
- Negative responses to the survey itself.

Survey Results (preliminary)

- Scientists were generally positive towards local law enforcement, IBCs and other authorities they are familiar with (65,16)
- Feelings towards federal law enforcement was more negative, but not as negative as it was towards immigration officials.(41,30+23,46)

...until they were asked details.

Survey results 2 (preliminary)

- When asked about sharing details of their work with different groups, they were split on whether they were receptive or unreceptive to federal law enforcement (36,36), intelligence community (34,42).
- Very receptive to discussing work with the public (87,3), and other scientists regardless of where they are from.



Survey Results 3 (preliminary)

When asked about their role as a scientist...

- Public safety risk (40,60), For criminal investigation (67,33), Terrorism investigation (52,48), IBC evaluation (84,16).



Survey Results 4 (preliminary)

- Working closely with law enforcement is good for the scientific community (62,38)
- More security equals more censorship (65,35)
- Aid in ongoing criminal investigation (76,24) terrorism investigation (63,37)
- For technical expertise (92,8)

Survey results 5 (preliminary)

- Concerned that interacting with law enforcement would lead to...
- Reading their personal e-mails (62,38)
- Be asked to monitor a colleagues activities (65,35)
- Misinterpret their research as a public safety risk (64,36)

Overall PRELIMINARY results show

- Fear of power and unhealthy paranoia.
- They respect scientific credentials over authority.
- Misunderstanding of what LE would contact them for.
- Worried about being monitored.
- Worried about having their research interfered with.
- However, 62% agreed to be contacted by FAS again.



Plans...

we need a scalable infrastructure to coordinate dual-use awareness and other biosecurity issues.



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Biological and Chemical Weapons >> Biosecurity and Biodefense Resource

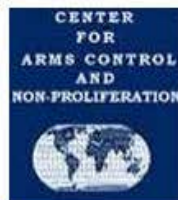
Biosecurity Education Portal

"Case Studies in Dual-use Biological Research" Federation of American Scientists



The "Case Studies in Dual-use Biological Research" illustrate the implications of "dual-use" biology research through case studies of different researchers who have done dual-use research and provides a historical background on bioterrorism, bioweapons and the current laws, regulations and treaties that apply to biodefense research. They include interviews with researchers as well as the primary scientific research papers and discussion questions meant to raise awareness about the importance of responsible biological research.

"Biosecurity: Risks, Responses, and Responsibilities" Center for Arms Control and Non-Proliferation



These online educational materials have been created for life scientists by life scientists. The materials are designed primarily for use by students embarking upon their careers - advanced undergraduates and first-year graduate biology and medical students - and for their teachers. Any not-for-profit use is encouraged, including instructional use in colleges, universities, and other institutions.

"The Dual-Use Dilemma in Biological Research" Duke University - Southeast Regional Center of Excellence for Emerging Infections and Biodefence



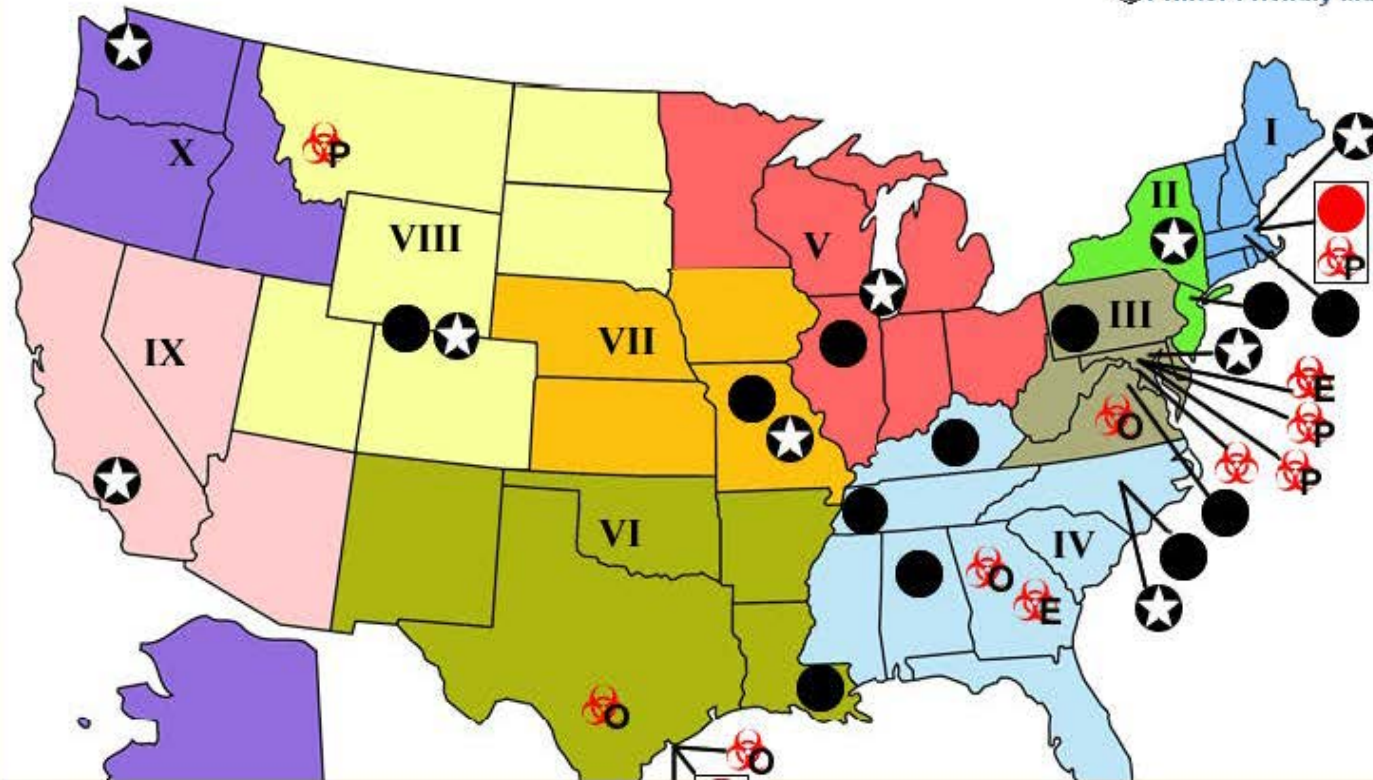
The SERCEB Policy, Ethics and Law Core has developed an online module to assist those involved with the biological sciences in better understanding the "dual-use" dilemma inherent in such research. This module is intended for graduate and post-graduate students, faculty members, and laboratory technicians involved in biological research in microbiology.

U.S. Biodefense Research Map

This interactive map provides the locations of both operational and planned **Biosafety Level-4 (BSL-4)** laboratories in the United States as well as the **National Biocontainment Laboratories (NBLs)**, the **Regional Biocontainment Laboratories (RBLs)**, and the **Regional Centers of Excellence (RCE) for Biodefense and Emerging Infectious Diseases**, both established by the National Institute of Allergy and Infectious Diseases (NIAID).

Search the organizations represented in the U.S. Biodefense Research Map for: [Advanced Search](#)

Printer-Friendly Map



The Biosecurity Community is NOT Communicating Well...

with scientists.

with the public.

with law enforcement.

with each other.

Partially because of funding issues



The Virtual Biosecurity Center

(partial funding begins in June 2008)

The Virtual Biosecurity Center

- A community resource to effectively communicate biosecurity efforts.
- One-stop shopping for biosecurity info.
- Built by FAS, Managed by the community
- Democratic management structure
- Encourage collaboration
- Create synergy.



Management structure

VBC

NAS

AAAS

CSIS

FAS

?

?

?

?

?

?



Novel Community Functions

- Daily news digest
- Host and disseminate material from other groups
- Promote material without bias
- Complementary content
- Immediate needs funding
- News media
- Keeping everyone linked on a daily basis.



Possible Expansion

- Law enforcement
- Public health
- International groups
- Scientific community
- Government Initiatives

Funding

- Funding is a significant issue for the NGO community.
- Important work is not being done.
- Filling the hole created by Carnegie Corporations priority shift is essential.



DC_Biosecurity list-serve

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